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JAN 24 2007

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop OP1-17
Washington, DC 20555

SUSQUEHANNA STEAM ELECTRIC STATION
LICENSEE EVENT REPORT 50-387/2006-006-00
PLA-6151 **Docket 50-387**

Attached is Licensee Event Report 50-387/2006-006-00. This event was determined to be reportable per 10 CFR 50.73(a)(2)(iv)(A) for an unplanned actuation of systems used to mitigate the consequences of significant events. On November 25, 2006, Susquehanna Unit 1 automatically scrammed in response to a generator lockout which was caused by a loss of generator field.

There were no actual consequences to the health and safety of the public as a result of this event.

No new regulatory commitments have been created through issuance of this report.

Robert A. Saccone
Vice President – Nuclear Operations

Attachment

cc: Mr. C. R. Welch, NRC Sr. Resident Inspector
Mr. S. J. Collins, NRC Regional Administrator, Region I
Mr. R. R. Janati, DEP/BRP
Mr. R. Osborne, Allegheny Electric

IE22

NRC FORM 366
(6-2004)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Susquehanna Steam Electric Station – Unit 1	05000387	1 OF 3

4. TITLE Automatic Scram due to Main Generator Lockout

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER 05000
11	25	2006	2006	006	00	1	24	2007	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE
1

10. POWER LEVEL
100%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER Voluntary Report
- Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMER *(Include Area Code)*
Eric J. Miller – Nuclear Regulatory Affairs	570-542-3321

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT *(Limit to 1400 spaces; i.e., approximately 15 single-spaced typewritten lines)*

On November 25, 2006 with Susquehanna Unit 1 in Mode 1 at 100%, the reactor automatically scrammed as a result of a turbine trip in response to a generator lockout. The main generator automatic voltage regulation circuitry did not positively respond to changes to the offsite grid which resulted in a loss of generator field and a subsequent unit shutdown. Investigation suggests that improper active/reactive current compensator (ARCC) settings in the automatic voltage regulation system were a probable contributor to this shutdown. In addition, a decision to forego modification of the automatic voltage regulators in a manner described in GE TIL 961-3, may also have contributed to the inability of Susquehanna's units to adequately respond to the grid disturbances. At the root of these suggested contributors to the shutdown, it has become apparent that there is a lack of sufficient, in-house understanding of the automatic voltage regulator response to a changing grid configuration. Until planned corrective actions are sufficiently completed, the Unit 1 Main Generator Voltage Regulator is being maintained in manual to ensure continued station operation during grid disturbances. In response to this event, the station intends to implement measures to ensure appropriate personnel fully understand generator control and protection schemes. Appropriate ARCC setting changes will also be established. Additionally, General Electric Technical Information Letter 961-3 will be re-evaluated and implemented if such action will enhance the unit's ability to respond correctly to grid disturbances.

This situation is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an unplanned actuation of a system designed to mitigate the consequences of a significant event. There were no actual adverse consequences to the health and safety of the public as a result of this event.

LICENSEE EVENT REPORT (LER)

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

EVENT DESCRIPTION

At 2042 hours on November 25, 2006 with Susquehanna Unit 1 in Mode 1 at 100%, the reactor (EIIS Code: AC) automatically scrammed as a result of a turbine (EIIS Code: TA) trip in response to a main generator (EIIS Code: TB) lockout. The main generator exciter (EIIS Code: TL) voltage regulation circuit did not positively respond to changes to the offsite grid which resulted in a loss of main generator field, thus causing the lockout. Investigation suggests that improper active/reactive current compensator (ARCC) settings in the automatic voltage regulation system were a probable contributor to this shutdown. The improper compensator settings, attributable to a simple knowledge deficiency, were also believed to have played a significant role in a similar shutdown that occurred on Susquehanna Unit 2 in June 2005. Investigation has also identified that a decision to forego modification of the automatic voltage regulators in a manner described in GE TIL 961-3, may also have contributed to the inability of Susquehanna's units to adequately respond to the grid disturbances.

All control rods inserted and all safety systems responded as designed in response to the automatic scram. Immediately following the scram, five Safety Relief Valves (EIIS Code: SB) opened and then properly reseated. Both Reactor Recirculation pumps (EIIS Code: AD) tripped as expected in response to the pressure transient. The Main Steam (EIIS Code: SB) Bypass Valves were subsequently able to control reactor pressure. Reactor water level dropped to approximately 13 inches and was readily restored to the normal level of 35 inches by the Feedwater system (EIIS Code: SJ). Several balance of plant systems were impacted by the generator voltage perturbation but there were no unusual challenges to the station's safety-related electrical systems. There were no challenges to Containment (EIIS Code: NH) or evidence of fuel failure as a result of this event. Unit 1 was returned to service on November 29, 2006 with the Unit 1 Main Generator Voltage Regulator in manual. This situation is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an unplanned actuation of a system designed to mitigate the consequences of a significant event. This event did not produce adverse consequences to the health and safety of the public.

CAUSE OF EVENT

Less than adequate tuning of the active / reactive current compensator (ARCC) in the automatic voltage regulation system resulted in undesirable interactions between the Susquehanna Units during the grid disturbance experienced on November 25, 2006. The ARCC settings on both Susquehanna Unit 1 and Unit 2 have not been optimized for the current plant configuration. The function of the ARCC circuitry is to control the automatic voltage regulator such that the generator terminal voltage is compensated for the reactive losses between the generator and the desired control point inside the generator's step-up transformers. The high settings of the ARCC on both Susquehanna's Units may have caused the regulation points for Unit 1 and Unit 2 to become too closely aligned. The interaction of the automatic voltage regulators of both units led to the over excitation of one unit and the loss of excitation of the other unit. When considering both the June 2005 scram and this scram, it appears that the unit operating with the higher generator field current after the grid transient would survive the transient. Investigation has revealed that PPL Susquehanna, LLC relies heavily on the knowledge and expertise of electrical distribution personnel when establishing ARCC settings. In order to reduce the reliance on those company entities that are not directly responsible for the operation of Susquehanna, corrective actions will be established to ensure appropriate personnel clearly understand generator control and protective schemes.

GE Technical Information Letter (TIL) 961-3 has not been implemented at Susquehanna. Because, the voltage regulation system design at Susquehanna was considered adequate, it was felt that implementation of TIL 961-3 could only provide enhancement. It is now believed that implementation of TIL 961-3 could help the excitation system recover from disturbances that drive generator excitation low. An evaluation will be performed to determine if implementation of TIL 961-3 is prudent for Susquehanna.

With the causal items described above, PPL Susquehanna, LLC believes that two important factors have been identified which have contributed to the overall event. At the root of these suggested contributors to the shutdown, it has become apparent that there is a lack of sufficient, in-house understanding of the automatic voltage regulator response to a changing grid configuration. Additional planned evaluation could produce further insight into the dynamics surrounding this situation.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

ANALYSIS / SAFETY SIGNIFICANCE

Actual Consequences:

On November 25, 2006, a grid disturbance led to a loss of field event on the Unit 1 Main Generator. The loss of the Unit 1 Main Generator field led to actuation of the Unit 1 bus lockout relays, a Unit 1 Main Turbine trip, and a Unit 1 Reactor Scram. All safety systems operated as expected. The reactor reached Operating Mode 3 in a stable condition.

Potential Consequences:

Challenges to nuclear safety can result from equipment failure or human errors during recovery of the reactor to normal shutdown conditions. The potential consequence results in a negligible increase in the probabilistic risk to the health and safety of the public.

CORRECTIVE ACTIONS

The following corrective actions have been completed:

- Temporary monitoring equipment was installed on both the Unit 1 and Unit 2 auto voltage regulators.
- Main Generator stability tuning and minimum excitation limit adjustments were completed.
- Until planned corrective actions are sufficiently completed, the Unit 1 Main Generator Voltage Regulator is being maintained in manual to ensure continued station operation during grid disturbances.

The following corrective actions are planned:

- Training and/or processes will be developed and implemented to ensure appropriate PPL Susquehanna, LLC personnel understand generator control and protection schemes.
- Appropriate active / reactive current compensator (ARCC) setting changes will be established and implemented.
- General Electric Technical Information Letter 961-3 will be re-evaluated and implemented as appropriate. (Full or partial implementation of TIL 961-3 may enhance the unit's ability to respond correctly to grid disturbances.)

ADDITIONAL INFORMATION

Failed Components Information:

None

Past Similar Events:

Docket No. 50-388 LER 2005-005-00 and LER 2005-005-01